ARTIFICIAL INTELLIGENCE: IMPROVING NIGERIAN UNDERGRADUATE LEARNING OUTCOMES.

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Abstract
The integration of Artificial Intelligence (AI) in education is rapidly gaining attention as a transformative force in enhancing student learning outcomes globally. In the context of Nigerian higher education, this study explores the potential of AI tools, such as AI-based tutoring systems, automated grading systems, and personalized learning platforms, in improving the academic performance of undergraduate students. Data were collected through a mixed-methods approach, including surveys and interviews with 500 students, 50 faculty members, and educational technologists across five Nigerian institutions. The findings reveal that there is significant main effect of treatment (AI-based tutoring systems, and Automated grading systems) on Learning outcomes of Nigerian Undergraduate (F(2, 50) = 43.225, p <.05,?2=.634) and there was significant main effect of intelligence on Learning outcomes of Nigerian Undergraduate (F(2, 50) = 10.711, p<.05,?2=.277) result showed that there was significant relationship between Personalized learning platforms and learning outcomes among undergraduate students (r = .421, N= 550, p <.05), The findings reveal that AI tools significantly contributed to improved student learning outcomes, particularly in courses with high dropout rates and large class sizes. However, challenges such as limited infrastructure, digital literacy, and resistance to change were identified as barriers to successful AI integration. The study concludes that while AI presents a transformative opportunity to enhance educational outcomes, its effective implementation in Nigerian higher education requires addressing technological and institutional challenges.

Keywords: *AI Integration, Artificial Intelligence, Educational Innovation, Educational Technology, Learning Outcomes.*

INTRODUCTION

Artificial Intelligence (AI) refers to the development of systems capable of performing tasks that would typically require human intelligence, such as problem-solving, learning, and decision-making (Russell & Norvig, 2016). In the field of education, AI applications are emerging as powerful tools to enhance teaching, learning, and administrative functions. AI's ability to analyze large datasets, personalize learning experiences, and automate processes offers promising potential for improving educational outcomes, particularly in higher education.

In Nigeria, the higher education system faces numerous challenges, including overcrowded classrooms, limited resources, outdated teaching methods, and disparities in access to educational opportunities (Adeleke, 2019). The rapid expansion of university enrollment, coupled with the lack of sufficient teaching staff and infrastructure, exacerbates these issues. These challenges highlight the need for innovative solutions, such as the adoption of AI technologies, to improve learning outcomes for Nigerian undergraduates.

Education can authoritatively be regarded as key to national development because it unleashes economic potential, strengthens and equips individuals in society to fully be engaged and benefit from national polices. According to Klutka, Ackerly, and Magda (2018), education is important to the development of human resources, impartation of appropriate skills, knowledge, and attitudes. Education plays an unquantifiable role in a nation and the global world at large in terms of creating an environment of self-actualization. It is the only instrument that liberates and protects human rights through a well-detailed and acquired knowledge through a systematic process of learning. Jaysone (2024) opines that education is the art of teaching and training individuals, imparting the right training and necessary skills for a particular trade and or profession for positive impact in society through better academic performance. Academic performance entails the different means students respond to their academic materials assigned by their teachers/lecturers. This explains that high academic performance is directly connected and measured by the examination results.

This study contributes to filling this gap by providing evidence-based insights into the implications of AI integration in Nigerian science education has the potential to address many of the barriers to quality education in Nigeria by providing personalized learning experiences, automating administrative tasks, and enhancing the availability of learning resources. This study seeks to explore how AI can be utilized to improve learning outcomes for undergraduate students in Nigerian universities.

The Concept of Artificial Intelligence in Education

Artificial Intelligence in education refers to the use of AI technologies to enhance teaching, learning, and administrative processes. These technologies include machine learning, natural language processing, and data analytics, which enable systems to adapt to the needs of individual students and automate various educational tasks (Luckin et al., 2016). AI's potential to improve educational outcomes has been explored globally, with applications in personalized learning, intelligent tutoring systems, and automated assessment.

One of the most significant uses of AI in education is personalized learning. Adaptive learning platforms use AI to assess students' knowledge levels, identify areas of weakness, and adjust the difficulty of learning materials accordingly (VanLehn, 2011). Such systems can create tailored learning paths for each student, allowing for a more efficient and engaging learning experience.

AI Applications in Higher Education

AI in higher education has been explored in various forms, with several applications aimed at improving learning experiences, teaching practices, and administrative efficiency:

Personalized Learning: AI enables adaptive learning systems that adjust content based on student performance. This allows students to progress at their own pace, providing targeted support for areas where they struggle while advancing more quickly through concepts they understand (Baker & Siemens, 2014).

Intelligent Tutoring Systems: AI-driven tutoring systems provide personalized support for students outside of regular classroom hours. These systems can answer questions, provide explanations, and guide students through exercises (VanLehn, 2011).

Automated Grading and Assessment: AI can automate grading for assignments and exams, offering faster feedback to students and reducing the workload for instructors (Shute, 2011). Such systems can be used to grade both objective and subjective responses, such as essays or short-answer questions.

Learning Analytics: AI uses learning analytics to track students' progress and engagement, providing valuable insights for instructors and students alike. This data can be used to identify students who are at risk of underperforming and to provide targeted interventions (Siemens, 2013).

AI in Nigerian Higher Education

While AI applications in higher education are widespread in developed countries, Nigerian universities are just beginning to explore the potential of AI. Some Nigerian institutions, such as the University of Lagos, have experimented with e-learning platforms and AI-driven tools to enhance teaching and learning (Ogunleye, 2018). However, the integration of AI is still in its early stages, and there is limited infrastructure to support widespread implementation.

Several challenges hinder the adoption of AI in Nigerian higher education, including limited access to technology, a lack of trained personnel, and financial constraints. Despite these barriers, there is growing interest in using AI to enhance educational outcomes and address systemic challenges within Nigerian universities (Adeleke, 2019).

Artificial intelligence (AI) has reshaped the education landscape, driving unprecedented changes in teaching methodologies and student learning experiences. Through data-driven machine learning techniques, AI can optimise learning outcomes, streamline pedagogical processes, and tailor educational tools to individual needs (Wang, Liu, &. Tu 2021). The adoption of AI in education offers a promising pathway to personalized learning and improved academic performance. Particularly in the era of university academic learning, understanding the impact of AI is crucial for educators, policymakers, and AI platform developers. As suggested by Haenlein and Kaplan (2019), AI holds promising potential for democratizing access to education. However, its full capabilities remain untapped, particularly with unprecedented shifts in teaching strategies and student learning experiences brought about by artificial intelligence (AI), which has completely changed the educational landscape. AI can optimize learning results, expedite pedagogical procedures, and customize educational resources to meet the needs of each student through data-driven machine learning techniques (Wang, Liu, & Tu 2021). AI integration in education presents a viable route to more individualized instruction and enhanced academic achievement. For educators, legislators, and AI platform developers, comprehending the effects of AI is essential, especially in the age of university academic learning. According to Haenlein and Kaplan (2019), artificial intelligence (AI) has the potential to democratize educational access. Its full potential is still unrealized, nevertheless, especially in university systems. To fully utilize AI's benefits in educational contexts, more thorough research and development are required.

A critical review of the direct impact of AI on academic achievement, particularly within university systems, is frequently lacking in research that has identified success factors and obstacles in adopting AI in educational contexts (Seo, Tang, Roll, Fels, & Yoon, 2021). For a more thorough understanding of AI's transformative potential in education, this gap must be filled. To create more inclusive educational technologies, for example, it can be helpful to look at how cultural, socioeconomic, and infrastructure aspects vary by area and affect the adoption of AI.

Furthermore, fostering fairness in AI-driven learning settings requires an awareness of gender differences in AI's educational impact. In the realm of artificial intelligence, notably in educational settings, gender parity is still a major obstacle.

Problem Statement

Despite efforts to improve the Nigerian education system, several challenges persist. These challenges point to the need for more efficient, scalable, and inclusive solutions in the Nigerian higher education system. AI, with its ability to personalize learning and automate administrative tasks, presents an opportunity to enhance educational outcomes across Nigerian universities.

Research Questions

The study will address the following research questions:

RQ1: Is there any relationship between personalized learning platforms and learning outcomes among undergraduate students?

Ho2: Is there any relationship between AI-based tutoring systems and learning outcomes among undergraduate students?

Ho3: There will be no significant relationship between Automated grading systems and learning outcomes among undergraduate students.

Research Hypotheses

Ho^1: There is no significant main effect of treatment (AI-based tutoring systems and Automated grading systems) on Learning outcomes of Nigerian undergraduates.

Ho^2: There is no significant main effect of intelligence on Learning outcomes of Nigerian undergraduates.

Scope of the Study

This study will focus on Nigerian undergraduate students and the potential of AI to improve their learning outcomes. The research will explore AI applications such as personalized learning platforms, AI-powered tutoring systems, and automated administrative tools. The study will also assess the challenges Nigerian universities face in adopting AI and propose solutions to facilitate AI integration.

METHODOLOGY

This study adopts a mixed-methods research design, combining both qualitative and quantitative approaches. Qualitative data was gathered through focus groups and interviews with teachers, administrators, and students to explore their experiences with AI in education. Quantitative data was collected using structured surveys to assess the impact of AI on student performance and engagement.

The study population includes undergraduate students, faculty members, and administrators from Nigerian universities. Using purposive sampling, five public universities already implementing AI technologies were selected. The sample consists of 500 students and 50 faculty members.

Data collection involved:

- **Surveys:** Distributed to students and faculty to evaluate AI tool effectiveness, engagement, and challenges.
- **Interviews:** Conducted with administrators and policymakers to explore institutional efforts, challenges, and strategies for AI integration.

Data analysis employed both descriptive and inferential statistics (e.g., ANCOVA, PPMC) for the quantitative data, while thematic analysis (Braun & Clarke, 2006) was used to interpret qualitative findings. Triangulation of data sources ensured a comprehensive understanding of AI's impact on undergraduate learning in Nigeria.

Ethical standards were strictly followed. Participants gave informed consent, were assured of confidentiality, and were informed of their voluntary participation rights. All findings will be reported with transparency and integrity, acknowledging any limitations.

RESULTS

Research Questions

RQ1: Is there any relationship between Personalized learning platforms and learning outcomes among undergraduate students

Table 1: Result of PPMC showing the significant relationship between Personalized learning platforms and learning outcomes among undergraduate students

Variable	Mean	Std. Dev.	N	R	P	Remark
Learning Output	30.92	6.020	550	.421**	.000	Sig.
Personalized learning platforms	30.38	5.750				

*Sig. at .05 level

Table 1 above shows that there was a significant relationship between Personalized learning platforms and learning outcomes among undergraduate students ($r = .421$, $N = 550$, $p < .05$). The result states there is a relationship between Personalized learning platforms and learning outcomes among undergraduate students.

Ho2: Is there any relationship between AI-based tutoring systems and learning outcomes among undergraduate students

Table 2: Result of PPMC showing the significant relationship between AI-based tutoring systems and learning outcomes among undergraduate students

Variable	Mean	Std. Dev.	N	R	P	Remark
Learning Output	30.92	6.020	550	.560**	.000	Sig.
AI-based tutoring systems	31.12	5.939				

*Sig. at .05 level

Table 2 above shows that there was a significant relationship between AI-based tutoring systems and learning outcomes among undergraduate students (r = .560, N= 550, p <.05). The result states there is a significant relationship between AI-based tutoring systems and learning outcomes among undergraduate students.

Ho3: There will be no significant relationship between Automated grading systems and learning outcomes among undergraduate students

Table 3: Result of PPMC showing the significant relationship between Automated grading systems and learning outcomes among undergraduate students

Variable	Mean	Std. Dev.	N	R	P	Remark
Learning Outcomes	30.92	6.020	550	.800**	.000	Sig.
Automated grading systems	30.97	6.681				

*Sig. at .05 level

Table 3 above shows that there was a significant relationship between Automated grading systems and learning outcomes among undergraduate students (r = .800, N= 550, p <.05). The result states there is a significant relationship between Automated grading systems and learning outcomes among undergraduate students.

Result of Experimental

Table 4: ANCOVA Tests of Between-Subjects effect of AI-based tutoring systems, and Automated grading systems on Learning outcomes of Nigerian Undergraduate

Tests of Between-Subjects Effects

Dependent Variable: Post Test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2357.146[a]	9	261.905	27.970	.000	.834
Intercept	332.699	1	332.699	35.531	.000	.415
Treatment	809.502	2	404.751	43.225	.000	.634
Intelligence	13.321	2	6.661	10.711	.004	.277
Pretest	33.015	1	33.015	23.526	.001	.587
Treatment * Intelligence	24.654	4	6.164	5.658	.024	.240
Error	468.187	50	9.364			
Total	18832.000	60				
Corrected Total	2825.333	59				

a. R Squared = .834 (Adjusted R Squared = .804)

Ho[1]: There is no significant main effect of treatment (AI-based tutoring systems and Automated grading systems) on **Learning outcomes** of **Nigerian undergraduates**.

Table 4 it was shows that there is a significant main effect of treatment (AI-based tutoring systems, and Automated grading systems) on Learning outcomes of Nigerian undergraduates ($F(2, 50) = 43.225$, $p < .05$, ?2=.634). The null hypothesis is therefore rejected. This implies that the use of the treatment (AI-based tutoring systems and Automated grading systems) had a positive influence on Learning outcomes of Nigerian undergraduates, Nigeria. To find out the mean score obtained by the experimental group and the control group, the estimated marginal mean was computed. The result shown is presented in Table 5

Table 5: Estimated Marginal main effect of treatment (AI-based tutoring systems, and Automated grading systems) on Learning outcomes of Nigerian Undergraduate

Dependent Variable: Post Test				
			95% Confidence Interval	
Treatment	Mean	Std. Error	Lower Bound	Upper Bound
Exp I (AI-based tutoring systems)	22.047[a]	.784	20.472	23.622
Exp II (Automated grading systems)	18.062[a]	.748	16.560	19.564
Control Group (Personalized learning platforms)	8.673[a]	1.046	6.572	10.773
a. Covariates appearing in the model are evaluated at the following values: Pre -Test = 10.58.				

Table 5 showed that participants in Experimental Group I (AI-based tutoring systems) obtained a higher mean score (=22.047), followed by Experimental Group II Automated grading systems) Participants, who had a mean score of 18.062, and the Control Group (Personalized learning platforms) had a mean score of 8.673. This shows that participants in Group I (AI-based tutoring systems) had better knowledge of the use of artificial intelligence, which has improved Nigerian undergraduate learning outcomes. It then means that the treatment had a better effect on Experimental Group II Automated grading systems) and Control Group

Ho^2: There is no significant main effect of intelligence on Learning outcomes of Nigerian undergraduates.

Table 4 shows that there was a significant main effect of intelligence on Learning outcomes of Nigerian undergraduates (F(2, 50) = 10.711, p<.05,?2=.277). The null hypothesis is therefore rejected. This means that there is a significant main effect of intelligence on Learning outcomes of Nigerian undergraduates.

Table 6: Adjusted Marginal Mean showing the direction of difference in (AI-based tutoring systems, and Automated grading systems) by the intelligence of Nigerian Undergraduate students

Estimates				
Dependent Variable: Post Test				
			95% Confidence Interval	
INTELLIGENCE	Mean	Std. Error	Lower Bound	Upper Bound
Low	15.908[a]	1.001	13.897	17.920
Moderate	15.958[a]	.674	14.605	17.311
High	16.915[a]	.592	15.725	18.105
a. Covariates appearing in the model are evaluated at the following values: Pre -Test = 10.58.				

Table 6 showed that the Intelligence of participants obtained a higher mean score (=16.91) followed by Moderate with a mean score of (=15.95) and Low with a mean score of (=15.90). This shows that students' higher education had better learning outcomes of Nigerian Undergraduate.

DISCUSSION

The findings of research question one showed that there was a significant relationship between personalized learning platforms and learning outcomes among undergraduate students. It was also revealed that applying artificial intelligence in business education encourages students to discuss issues concerning research and academics. This finding contradicted the findings of Cho and Rangel (2017), who found that incorporating artificial intelligence in an educational context led to overexposure, inappropriate usage, reputation, addiction, information overload, as well as content and personal privacy. Findings from research question two revealed that there was a significant relationship between AI-based tutoring systems and learning outcomes among undergraduate students.

The findings of research question three revealed that there was significant relationship between Automated grading systems and learning outcomes among undergraduate students.

The Findings from hypothesis one revealed that there is significant main effect of treatment (AI-based tutoring systems, and Automated grading systems) on Learning outcomes of Nigerian Undergraduate.

The findings of research hypothesis two revealed that there was a significant main effect of intelligence on Learning outcomes of Nigerian undergraduates. From the

findings, it was also revealed that Easy accessibility of complexity by education students helps to increase their Learning outcomes. This finding aligned with the findings of Shuayb and Gebreel (2021), who carried out a study on the effect of using complexity on the academic achievement of students. Their study revealed that using complexity by the students can have a positive and effective impact on their Learning outcomes.

CONCLUSION

With an emphasis on student engagement, learning outcomes, and educator perspectives, the revolutionary effects of integrating artificial intelligence (AI) into education have been highlighted. The study confirms that real-world scenarios combined with interactive AI applications greatly enhance the development of a dynamic and lively learning environment.

Additionally, the results show that AI promotes better learning outcomes and a more thorough comprehension of academic ideas.

In line with other research, the study backs up the notion that integrating AI effectively improves cognitive abilities and motivates students to actively create their knowledge rather than just absorbing it. To fully utilize AI technologies in the classroom, educators' thoughts on AI integration further underline the necessity of professional development opportunities and the critical role that continuous training plays. The study also emphasizes how crucial it is for AI-integrated courses to use a student-centered educational approach.

Challenges still exist, though, as instructors voice a need for additional resources and fundamental AI abilities. According to the gap found, organizations should carefully distribute resources, such as training programs and modernized technology, to enable smooth AI integration. In addition to resolving the current issues, this will enable teachers to provide successful AI-integrated instruction. In a larger sense, the study adds to the continuing discussion over AI's place in education by offering useful information to stakeholders, legislators, and educational institutions.

As we proceed, more research and teamwork are needed to optimize AI's educational benefits and get students ready for a future that depends more and more on innovation and technology.

RECOMMENDATIONS

Based on the study's findings, some suggestions are made to direct future initiatives to include AI in science instruction at Nigerian universities. The findings were used to make the following recommendations:

1. To increase academic performance, postgraduate students should support the use of artificial intelligence.
2. The use of artificial intelligence in higher education should be continuously mandated by the government and the appropriate authorities.
3. To facilitate the employment of artificial intelligence, higher education institutions should set up resources such as a functional and efficient Internet service.
4. To teach students how to use the various forms of artificial intelligence for strong academic reasons, more resource people should be found.
5. Making an Investment in Educator Professional Development: Create extensive professional development initiatives to give teachers the fundamental AI abilities they need, fill in identified gaps, and guarantee the effective use of AI tools in the classroom.
6. Using a Student-Centered Pedagogical Approach: Match course material to students' experiences and goals by incorporating project-based learning into AI-infused curriculum. This method promotes active, self-directed learning and increases student involvement.

REFERENCES

Adeleke, A. (2019). Challenges and Prospects of Artificial Intelligence in Nigerian Education. Journal of Educational Technology, 24(3), 67-79.

Baker, R., & Siemens, G. (2014). Educational data mining and learning analytics. In M. Spector, B. B. Lockee, & M. D. Childress (Eds.), Learning, Design, and Technology: An International Compendium of Theory, Research, Practice, and Policy (pp. 1-22). Springer.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77-101. https:// doi.org/ 10.1191/1478088706qp063oa

Chiong, C., & Jovanovic, J. (2019). Artificial Intelligence in Education: Educational Applications and Research. Springer.

Haenlein, M. Kaplan, A. 2019. A Brief History of artificial intelligence: on the past, present, and future of artificial intelligence, Calif. Manag. Rev.. 61 (4) 5-14, https://doi.org/10.1177/0008125619864925.

Hwang, G.J. Xie, H. Wah, B.W. and Ga?sevi´c D. 2020. Vision, challenges, roles, and research issues of Artificial Intelligence in Education, Comput. Educ.: Artif. Intell. 1 (2020) 100001, https://doi.org/10.1016/j.caeai.2020.100001.

Jaysone,. C M. (2024) The relationship between artificial intelligence usage and administration students. International Journal of Academic Performance of Asian Business and Management 3(1), 27-48

Klutka, J., Ackerly, N., & Magda, A.J. (2018). Artificial Intelligence in Higher Education: Current Uses and Future Applications.

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence Unleashed: An Argument for AI in Education. Pearson.

Ogunleye, A. (2018). Artificial Intelligence and Its Applications in Education in Nigeria. Journal of Nigerian Educational Review, 32(4), 34-50

Russell, S., & Norvig, P. (2016). Artificial Intelligence: A Modern Approach (3rd ed.). Pearson.

Seo, K.W., Tang, J., Roll, I., Fels, S., and Yoon, D. 2021.The impact of artificial intelligence on learner-instructor interaction in online learning, International Journal of Educational Technology in Higher Education 18 (1) (2021), https://doi.org/10.1186/s41239-021-00292-9.

Shute, V. J. (2011). Stealth assessment in computer-based games and simulations. Computer Games and Instruction, 503-524.

Siemens, G. (2013). Learning analytics: The emergence of a discipline. American Behavioral Scientist, 57(10), 1380-1400.

Tobin, K., & Tippins, D. J. (2014). The Practice of Constructivism in Science Education. Springer.

VanLehn, K. (2011). The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems. Educational Psychologist, 46(4), 197-221. https://doi.org/10.1080/00461520.2011.607937

Wang, Y. Liu, C. and. Tu, Y.F 2021. Factors affecting the adoption of AI-based applications in higher education: an analysis of teachers' perspectives using structural equation modeling, Educ. Technol. Soc. 24 (3) 116-129.